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CHAPTER 1

INTRODUCTION

Section I. General

1-1. Purpose. This manual provides guidance for the assessment of reservoir water quality conditions, including reservoir releases and tailwaters. Procedures are generally presented without theoretical discussion, since these details can be found in referenced sources.

1-2. Applicability. This manual applies to all field operating activities having responsibilities for reservoir water quality/ quantity control. It provides a framework to guide Corps of Engineers scientists and engineers in assessing water quality conditions associated with reservoirs. Emphasis is placed on procedures to define program and/or study objectives and to select appropriate techniques for assessing water quality conditions in the planning, design, and water control management of reservoirs.

1-3. Reference. The references are indicated throughout the manual by numbers that correspond to similarly numbered items in Appendix A.

1-4. Background.

a. Environmental concern expressed by the public through the Congress has resulted in the passage of Federal legislation and the issuance of Executive Orders directing increased efforts by Federal agencies in water quality management. Initial legislation on water quality management was directed toward public health and water supply. Subsequent legislation and Executive Orders, such as the Federal Water Pollution Control Act Amendments of 1977 (PL 95-217, 33 U.S.C 1323 et seq., "the Clean Water Act"), and Executive Order 12088 ("Federal Compliance with Pollution Control Standards," 13 October 1978), placed the responsibility for compliance with local and state pollution abatement laws with directors of Federal agencies. Corps policies and authorities relative to water quality are contained in ER 1130-2-334, ER 1105-2-50, and EP 1165-2-1.

b. Early reservoir water quality assessment activities were based on techniques and referenced processes commonly accepted in standard limnology and sanitary engineering. However, previous approaches to assessing and solving reservoir water quality problems were sometimes found to be lacking due to processes and water control operations inherent to reservoirs. Some of these water quality problems interfere with project purposes and/or result directly from water control (reservoir regulation) practices. Many of these problems were addressed by the Environmental and Water Quality Operational Studies (EWQOS) research program, and new technologies pertinent to reservoir water quality have been developed. Much of the material in this manual is a product

of this program and of field experience from Corps district and division offices.

Section II. Water Quality Assessment in Water Quality Control Management

1-5. General. Water quality assessments of reservoirs are designed and conducted to meet specific reservoir use objectives. These assessments are intended either for predicting future conditions, such as the reservoir water quality in a proposed impoundment or the tailwater quality resulting from proposed changes in the water control plan at an existing project, or for describing existing conditions, such as postimpoundment quality. In addition, the results of water quality assessments serve as source material for environmental impact statements and assessments, project water control manuals, recreation master plans, and future projects.

1-6. Planning and Analysis. The stage of the reservoir project investigation determines the extent of resources available and, therefore, the depth of a water quality assessment. Obviously, a reservoir water quality assessment made during the early stages of a project reconnaissance investigation is generally less intensive and definitive than assessments conducted during feasibility studies or those made for project feature design and environmental impact determination in the post-authorization phase.

a. Reconnaissance Studies.

(1) During the early phases of project planning investigations (reconnaissance), it is important to make an initial information search (Chapter 4, para 4-3) and determine existing water quality conditions in the watershed under study. Factors such as elevated levels of certain water quality constituents, municipal and industrial point-sources of pollution, land use practices, municipal water supply requirements, State stream water quality standards, and other water uses should be identified. These factors are extremely important in determining water quality assessment requirements and objectives for the next phase of the planning investigation.

(2) Limited resources and the fact that specific reservoir sitings and project purposes are not yet fully developed during the reconnaissance phase usually preclude the need for extensive field data collection or use of the diagnostic and predictive techniques described in Chapter 4.

(3) When the planning investigation progresses to the point at which alternative reservoir sites are considered, the process of assessing future reservoir water quality conditions begins. Usually, resources at this stage permit only limited field data collection. Predictive techniques will also ordinarily be restricted to the use of regression type and/or comparative type analyses (Chapter 4). The requirements at the stage of study are to provide a general indication of the proposed impoundment in terms of whether it will be strongly stratified, will have low dissolved oxygen or other gas

concentrations, and related water quality problems that would adversely affect project purposes or require special water control features (e.g., multilevel withdrawal structure or reaeration facility) for mitigation and control. This information will be used to scope the level and extent of the water quality assessment needed for the feasibility investigation.

b. Feasibility Studies.

(1) During the feasibility investigation (development of the recommended plan and preparation of the environmental impact statement), it may be necessary to use nutrient loading, thermal simulations, and/or comprehensive water quality models to predict future water quality and determine the need for specific water quality control features. In most cases, use of rigorous simulation models will require more water quality data than those gathered during the earlier planning work, and additional data collection and analysis will be required.

(2) Another analysis is to determine whether the proposed impoundment lands, through the presence of vegetation and certain soil types, will contribute to water quality degradation (see Chapter 4). Sufficient resources to conduct these water quality studies should be provided in the feasibility investigation. Also, the water quality control features and their associated operational requirements must be considered in the investigation so that accurate estimates of project costs and benefits can be made.

c. Post-authorization Studies. During the post-authorization phase, detailed design of project features and definitive environmental impact determinations are prepared. Resources must be programmed to conduct data collection, while water quality simulation studies may be conducted to select the type and determine the specific geometry of water control structures (e.g., gates, submerged weirs, stilling basins) to meet project purposes and water quality objectives. The studies during this stage will usually encompass use of the more rigorous water quality simulation models (Chapter 4). They may, in addition, require physical models to define project-specific hydrodynamic conditions in the reservoir and tailwater for subsequent use in mathematical models and/or for direct application to design. Guidance on hydrologic investigation requirements for water quality control is contained in ER 1110-2-1402.

1-7. Water Control Management.

a. Water quality assessments of existing reservoirs can vary in completeness and detail depending on the objective of the assessment. For compliance with ER 1130-2-334, it may be sufficient to carry out a monitoring program without resorting to modeling (especially when no water quality problems are identified at the reservoir). In this instance, trend-monitoring to identify possible problems/conditions may be the activity required.

b. For a reservoir in which a specific water quality condition has been identified or to which a change in project use is proposed (e.g., hydropower retrofit), the assessment may be as extensive as that used in post-authorization design studies. In this case, there may be need for extensive field sampling and laboratory analysis (Chapter 5) and for evaluation techniques such as mathematical and/or physical modeling. Further, correcting a water quality problem or meeting requirements of the new project purpose may require the design and construction of modifications to the outlet works and/or modifications to the water control plan.